DRAFT

MONITORING AND REPORTING PLAN – POST CONSTRUCTION

REMOVAL ACTION
NW NATURAL "GASCO" SITE

Prepared for Submittal to

U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, Washington 98101

Prepared by

Anchor Environmental, L.L.C.
6650 SW Redwood Lane Suite 110
Portland, Oregon 97224

On behalf of

NW Natural
220 NW Second Avenue
Portland, Oregon 97209

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%R	Percent recovery
Anchor	Anchor Environmental, L.L.C.
ARAR	Applicable or Relevant and Appropriate Requirement
AST	Aboveground storage tank
ASTM	American Society for Testing of Materials
BTEX	Benzene, toluene, ethylbenzene, and xylene
CCB	Continuing Calibration Blank
CCV	Continuous Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain-of-custody
CQAP	Construction Quality Assurance Plan
DEQ	Oregon Department of Environmental Quality
DGPS	Differential Global Positioning System
DNAPL	Dense non-aqueous phase liquid
DQOs	Data Quality Objectives
ECL	Office of Environmental Cleanup
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FC	Field Coordinator
FSP	Field Sampling Plan
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
i.d.	Inside diameter
ICV	Initial (or Independent) Calibration Verification
MARP	Monitoring and Reporting Plan
MARP	Monitoring and Reporting Plan
MDL	Method Detection Limit
MRL	Method Reporting Limit
MS/MSD	Matrix Spikes and Matrix Spike Duplicate
NAD	North American Datum
Order	Administrative Order on Consent

OSC	On-Scene Coordinator
PAH	Polycyclic aromatic hydrocarbons
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PM	Project Manager
PTFE	Polytetrafloroethylene
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Removal Action Objectives
RAPP	Removal Action Progress Plan
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SDG	Sample delivery group
SOPs	Standard Operating Procedures
SOW	Statement of Work
STL	Severn Trent Laboratories
TOC	Total Organic Carbon
tPAH	Total polycyclic aromatic hydrocarbons
TPM	Technical Project Manager
TS	Total Solids
USACE	U.S. Army Corps of Engineers

1 INTRODUCTION

NW Natural entered into an Administrative Order on Consent (Order) with the U.S. Environmental Protection Agency (EPA) on April 28, 2004 to perform a time-critical removal action at the "Gasco site" (Site) (EPA 2004) (Figure 1). The Order requires that NW Natural perform a number of actions associated with removing a tar body (as defined in the Order) from the riverbank and nearshore sediment adjacent to the site. The extent of the tar body was defined during the design characterization sampling (Figure 2). In accordance with the EPA-approved Final Removal Action Project Plan (RAPP; Anchor 2005), removal of the tar body was initiated in August 2005 and is scheduled to be completed by November 2005. This Monitoring and Reporting Plan (MARP) describes post-removal monitoring objectives and provides an overview of the monitoring approach, design of the monitoring program (e.g., sampling strategy, station locations and replication, field sampling methods, laboratory methods), data analysis and interpretation, reporting requirements, post-removal site control, and contingency response and adaptive management. The monitoring information will be used to monitor this temporary cap at the Site and to evaluate the potential for capping as a final remedy for some or all of the Site. The information gathered is not intended to monitor a permanent remedy at the Site.

1.1 Project and Data Collection Objectives

1.1.1 RAOs Identified in the SOW

The Removal Action Objectives (RAOs) for the project are defined in Section II of the SOW and are reviewed in the RAPP. The objectives that are relevant to post construction monitoring include evaluating the cap's ability to isolate any residual contamination, monitoring for seepage of product in the low spot created by the removal, and providing information that contributes to the efficient performance of any anticipated long-term remedial actions.

In addition to these RAOs, the capping was also designed to include an engineered pilot sediment remediation cap placed over a portion of the removal area following completion of the dredging (Figure 3). The objectives of the engineered pilot cap are discussed below.

1.1.2 Objectives for Engineered Pilot Cap Study

The purpose of the engineered pilot cap is to place a barrier over a portion of the removed tar body and monitor the performance of the cap until the Portland Harbor RI/FS is completed and EPA selects a final remedy for the Site. The monitoring information collected, as described in this MARP, will be used to help understand whether residual contamination in sediments or any potential migration of contaminants from upland groundwater might be effectively managed through a capping type remedy. Information from the pilot study will be used in subsequent sediment remediation evaluations for shoreline sediments at the Site. The engineered pilot cap is designed to withstand erosive forces that might reasonably be expected over the next few years while the Site-wide remedial alternatives are evaluated. The engineered pilot cap is not intended as a long-term permanent remedy for this area, although it might be integrated into a wider capping approach should capping be determined to be an effective remedy for the Site.

1.1.3 Data Collection Objectives to Meet RAOs and Pilot Study Objectives

Post remedial action field monitoring within the removal action area is required by the Order and will provide information necessary to evaluate the performance of the engineered pilot cap. Field data collection will:

- Evaluate the nature and extent of potential seepage of product-like material in the bathymetric "low spot" created by the dredging activities
- Evaluate whether groundwater seepage from upland sources occurs that recontaminates the removal action area
- Monitor cap stability over the 3-year design life

In addition, for the pilot study portion of the effort, as defined in the Army Corps of Engineers (USACE) Guidance for Subaquaeous Dredged Material Capping (USACE 1998a) an engineered cap should function to provide physical isolation of contaminated sediments from biota, stabilize contaminated sediments such that they do not re-suspend into the water column, and reduce the flux of dissolved contaminants to the water column. Consistent with these functions, monitoring of the engineered pilot cap effectiveness over time would target the following field data collection objectives:

- Document variations in cap thickness

- Evaluate cap stability
- Document changes in surface sediment quality
- Determine cap porewater quality

2 MONITORING APPROACH

2.1 Monitoring Rationale

To achieve the data collection objectives defined in Section 1.1.3, a variety of field monitoring methods will be employed, as discussed below.

- **Visual/Diver Inspection (RAO specific)** – Diver surveys will be performed within the removal action area to visibly evaluate the nature and extent of potential seepage of material in the bathymetric "low spot" created by the dredging activities and to visibly evaluate the integrity of the engineered pilot cap and surrounding fringe cover areas.
- **Bathymetric Survey (RAO specific)** – Bathymetry surveys will be performed within the removal action area to monitor changes in mudline elevation and assess changes in cap thickness. Physical cores taken for seepage monitoring will also be used to assess cap thickness directly.
- **Seepage Monitoring (RAO specific)** – Seepage monitoring will be performed through the collection of sediment cores, penetrating through the pilot cap. The subsurface cores will be sectioned so as to monitor changes in concentrations just above the interface of the mixing zone between the pilot cap and underlying sediment. The core samples will be horizontally and vertically co-located with the porewater samples (discussed below) to facilitate direct comparison of the bulk sediment and porewater concentrations just above the pilot cap-sediment interface. The subsurface sediment samples will be analyzed for PAHs, BTEX, and cyanide. In addition, if a new depositional layer of surface sediment overlies the pilot cap this material will be sampled (volume permitting) and analyzed to evaluate whether sediment transport and deposition on the pilot cap may be contributing chemicals to the cap. Samples of depositional sediment will be analyzed for the full list of Portland Harbor Superfund Site contaminants of interest (Integral et al. 2004). The physical characteristics throughout the core will also be evaluated to determine the extent of mixing within the pilot cap.
- **Porewater Migration Sampling (Pilot Study Specific)** – Porewater migration through the pilot cap will be monitored through the collection of porewater samples just above the pilot cap-sediment interface. The porewater samples will be analyzed for PAHs, BTEX, and cyanide. The physical characteristics throughout the core will also be evaluated to determine the extent of mixing of surface sediments and the cap

materials. The porewater samples will be co-located with the seepage monitoring sediment stations. The physical characteristics identified in the co-located core will also be evaluated to determine how mixing of surface sediments and the cap materials may affect the porewater concentrations.

2.2 Monitoring Area and Locations

Monitoring will be restricted to within and immediately surrounding the engineered cap and fringe cover areas (Figure 2). Visual inspection will be conducted from the landside or waterside (using divers and/or underwater cameras) using appropriately spaced transects that allow the monitoring personnel to adequately record the physical attributes of the cap and surrounding perimeter. The bathymetry surveys will be conducted from the waterside and extend to 50 feet beyond the edge of the fringe cap (Figure 3). Seepage monitoring (surface and subsurface sediment samples) and porewater migration sampling (porewater and subsurface sediment samples) will be collected along a single transect containing three sampling stations (Figure 4). The samples were selected to be representative of the extreme nearshore, central, and channel ward portions of the removed tar body. This sampling design will capture any variations in seepage and/or porewater migration with distance from the shoreline and at variable mudline elevations.

2.3 Monitoring Frequency

The visual inspection, bathymetry, seepage, and porewater migration monitoring activities will be conducted in Year 0, Year 1, and Year 3 following completion of the removal action in November 2005. The Year 0 monitoring will occur shortly after completion of capping (generally within 1 month) and provide the baseline information upon which the Year 1 and Year 3 data will be compared. If the Year 1 sampling results indicate a significant change in bathymetry or cap thickness within the removal action area, additional monitoring may be warranted between Year 1 and Year 3. The need for additional monitoring, if any, will be determined by NW Natural and EPA when the Year 1 data is submitted. EPA anticipates selecting a final remedy for the Site as part of remedy selection for the Portland Harbor Superfund Site by the end of 2008; NW Natural assumes that any further monitoring beyond Year 3 monitoring in 2008 would be performed in connection with remedial design or implementation.

In addition to the proposed monitoring described above, additional monitoring may be conducted if flow conditions exceed the design parameters or substantial evidence of other natural or anthropogenic activities indicates a real potential for impacts to the engineered pilot cap. Any additional monitoring would be coordinated with EPA.

2.4 Monitoring Methods

The visual inspection, bathymetry, seepage, and porewater migration monitoring activities will be conducted in accordance with the Sampling and Analysis Plan (SAP), which is comprised of the Field Sampling Plan (FSP) (Appendix A) and Quality Assurance Project Plan (QAPP) (Appendix B).

3 RESULTS REPORTING

3.1 Data Reduction, Analysis, Interpretation, and Reporting

3.1.1 Visual Inspection

The visual inspections will serve to determine the presence/absence of nearshore seeps and erosional areas of the cap through visual evidence. During the visual survey, the monitoring personnel will keep detailed notes of areas, if any, that indicate the presence of subsurface seeps as well as areas where visible erosion or accretion of the cap has occurred. The information gathered during these surveys will help determine if additional monitoring is necessary to assess groundwater seepage through the cap and/or areas of potential cap failure. If seeps or cap erosional areas are identified, attempts will be made to photograph the identified area. The visual inspection results will be summarized in the monitoring reports.

3.1.2 Bathymetry Survey

The Year 0 post-capping bathymetric survey will be conducted as part of the Construction Quality Assurance Plan (CQAP, Appendix B of the RAPP; Anchor 2005) immediately following placement of the final cap surface. This survey will serve as the baseline to compare the subsequent Year 1 and Year 3 monitoring surveys. Changes in bathymetry over time will be evaluated to identify areas of significant erosion, deposition, or consolidation of the engineered pilot cap. Elevation changes of greater than 6 inches will be highlighted on the bathymetry maps. General response actions based on bathymetry and other results are identified in Section 5. The bathymetry survey results will be summarized in the monitoring reports.

3.1.3 Seepage Monitoring

The Year 1 and Year 3 subsurface sediment analytical results will be tabulated and compared to the Year 0 baseline results. The data will be evaluated to determine if the chemical concentrations increase over time just above the interface of the mixing zone between the engineered pilot cap and underlying sediment, indicating seepage of contaminated groundwater through the cap. In addition, if a layer of surface sediment overlies the engineered pilot cap this material will be sampled (volume permitting) and the surface sediment analytical results will be compared to the underlying subsurface sediment results to evaluate whether sediment transport and deposition on the

engineered pilot cap may be contributing to contamination of the cap layer. The physical characteristics of the surface and subsurface sediments will also be compared over time to assess mixing within the cap layer. Response actions based on seepage results are discussed in Section 5. The seepage monitoring results and evaluation will be summarized in the monitoring reports.

3.1.4 Porewater Migration Sampling

The Year 1 and Year 3 subsurface engineered pilot cap/sediment interface results will be tabulated and compared to the Year 0 baseline results. The data will be evaluated to determine if the chemical concentrations increase over time indicating migration of contaminated groundwater through the cap. The porewater chemical results will also be compared to the co-located subsurface sediment chemical results to correlate changes in porewater and bulk sediment chemical concentrations over time. The porewater migration sampling results and evaluation will be summarized in the monitoring reports. It should be noted that collection of representative porewater samples very close to a cap/underlying sediment interface can be very difficult to do accurately. Experience on past projects has shown that a number of potential sampling artifacts can occur. Porewater sampling results will always be evaluated in the context of the potential for such artifacts before conclusions are drawn about potential migration rates. Potential artifacts include: difficulty sampling a layer very close to the underlying sediments' unobservable physical mixing layer, inaccuracies in probe location due to small variations in cap thickness leading to sampling of the underlying sediments, pumping of porewater across the mixing layer (in cases where the probe tip is too close to the cap-sediment interface), and disturbance of the cap caused by placement of the probe itself.

3.2 Report Contents

Monitoring reports will be prepared following all monitoring events and will evaluate all data collected to date. The reports will present comparisons of the baseline survey (Year 0) and Year 1 and Year 3 monitoring data with respect to the RAOs and engineered pilot cap objectives. At a minimum, the following will be included in each monitoring report:

- Summary of all field activities, including a description of any deviations from the EPA-approved SAP (FSP and QAPP) and/or MARP

- Locations of areas of erosion and/or accretion identified during the visual/diver surveys
- Locations of any visible product or groundwater seeps
- Presentation of bathymetric data and comparison to baseline data
- Location of surface and subsurface sediment and porewater sampling stations in latitude and longitude coordinates to the nearest meter
- Project maps with actual sampling locations
- Final quality assurance/quality control QA/QC validation report
- Data results, including electronic copies of field logs, laboratory analysis results, and associated QA/QC data. All electronic data files will be stored in a data management system such as Equis®
- Recommendations of appropriate changes to the MARP, if necessary, to ensure the continued successful performance of the cap

3.3 Reporting Schedule

The reports will be prepared and submitted to EPA within 60 days of receipt of validated data results from the Year 0 (2005), Year 1 (2006), and Year 3 (2008) monitoring phases, or on a date determined in consultation with EPA.

4 POST CONSTRUCTION PROJECT CONTROLS

4.1 Proposed Controls

Given the industrial nature of the area, and the small aerial extent of the former tar body, future recreational use of the site is anticipated to be minimal. Thus, the proposed Site controls consist of the following for protection of the capped area:

- Written notification to the Site tenants about the presence of the cap, which will include the following:
  - Instructions and maps that show areas where boat and ship traffic should be minimized and anchoring prohibited
  - Instructions for tugboat operators to direct propeller wash away from the capped area
  - Identification of a preferential tug use area on maps to show operators accessing the adjacent oil pipeline the tug work areas adjacent to the pipeline dock
  - Direction that all proposed work in the vicinity of the cap should be cleared with NW Natural prior to starting work
  - Direction that excavation and/or purposeful sediment disturbance shall not be conducted in the capped area
  - Direction that NW Natural shall be notified in the event of any possible damage to the engineered cap
- Posting signs on the beach and oil pipeline. The signs will delineate the general aerial extent of the engineered cap, and prohibit recreational use and boat anchorage in the capped area. The signs will also prescribe a no wake area around and over the cap.

4.2 Documentation Procedures

NW Natural or its representatives will maintain a record of all correspondence with Site tenants, if any, documenting any potential damage to the engineered cap. The condition of the engineered cap and ongoing monitoring results will be reported to EPA in the monitoring reports.

4.3 Notification Procedures

In the event of potential damage to the cap, NW Natural will notify EPA and provide EPA with a proposed response. EPA will also be involved in all levels of the tiered adaptive management process described in Section 5.2.

5 CONTINGENCY RESPONSE AND ADAPTIVE MANAGEMENT PROCESS

5.1 Contingency Response Approach

If a condition occurs that requires attention, a tiered adaptive management process will be implemented. The following conditions could occur in the capped area that would potentially lead to a contingency response:

- The physical integrity of the cap is compromised (such as identification of scour or other damage in the capped area).
- Identification of product seeps through the cap.

If either of these conditions is identified during the cap monitoring program, a tiered contingency response approach will be followed as described in this section. It should be noted that porewater migration monitoring results will not be evaluated in the context of contingency response because these data are being collected solely for pilot cap evaluation purposes.

5.2 Tiered Adaptive Management Process

In the tiered adaptive management process, the contingency response would follow a sequence of actions once a trigger has been identified by the monitoring program. The adaptive management process is a hierarchy that describes the order in which each action would occur. The following levels of approach will be used when a trigger has been identified:

- Level 1: Once an issue has been identified (e.g., bathymetry survey shows significant erosion of the cap), the data will be re-examined, and additional data analyses will be performed as necessary. EPA and NW Natural will evaluate the initial data and review any additional analyses performed.
- Level 2: If the issue is not resolved during the Level 1 response, additional data collection will be performed. For example, if a core sample through the cap indicates the cap has been eroded, another core sample would be collected to verify the condition identified, and to better delineate the area over which the condition is occurring if necessary. NW Natural and EPA would evaluate the original and new data to determine if the issue requires additional response.
- Level 3: If the Level 1 and Level 2 response tiers indicate that further action is necessary, appropriate actions will be coordinated with EPA. While the Level 3 tier

would typically follow the Level 1 and Level 2 actions, there could be times where it is appropriate to initiate a Level 3 action immediately without the additional analyses and data collection in Level 1 or Level 2.

6 REFERENCES

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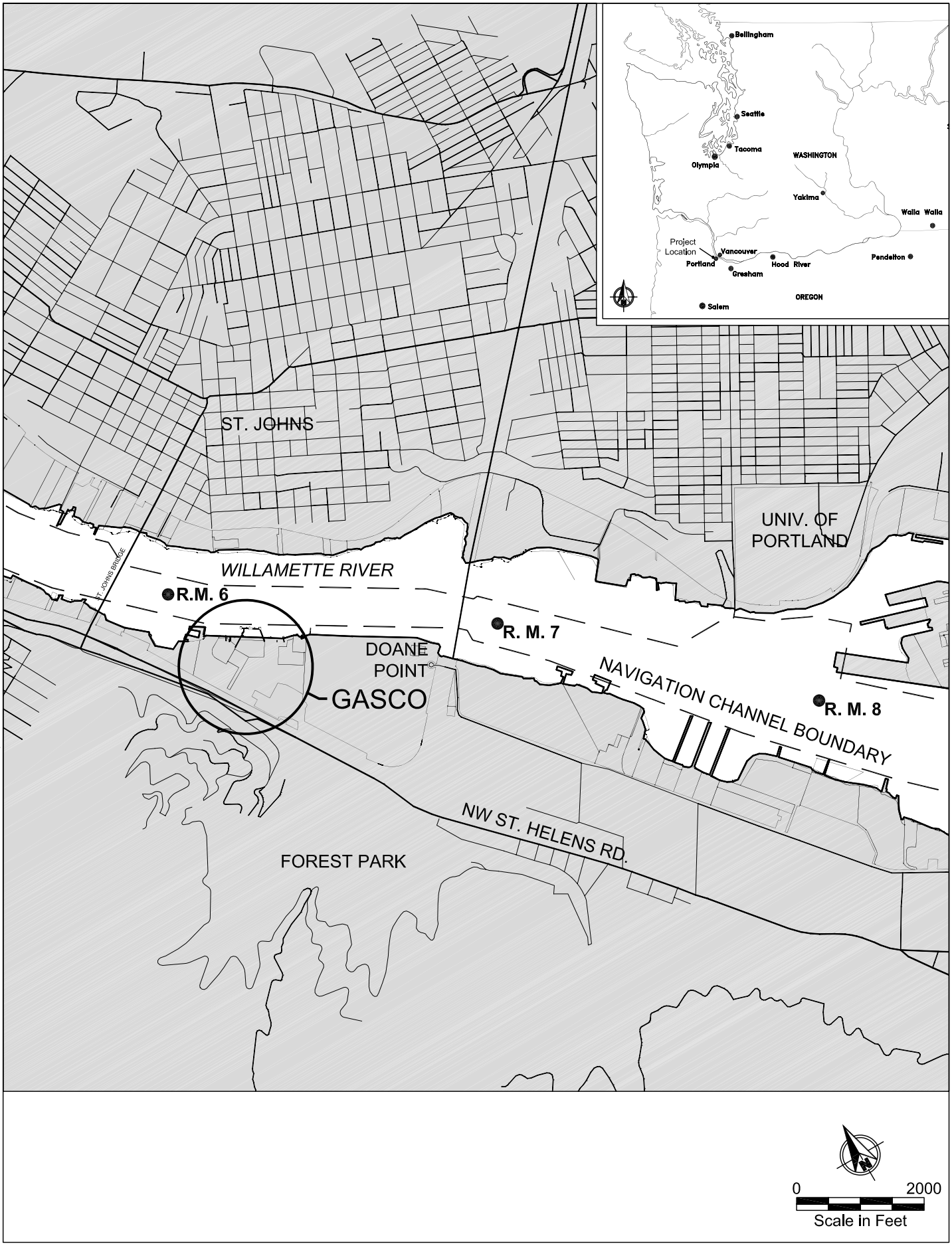
FIGURES



Oct 03, 2005 10:07am dholmer K:\Jobs\000029-GASCO\00002902\00002902-01.dwg FIG 1

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1
Vicinity Map
NW Natural "Gasco" Site

Legend:

- Lateral Extents of Suface Tar Body in Removal Action Area
- **RAA-01** Design Characterization Sediment Core Location (Anchor 2004)
- *-33.5* Bottom Elevation of Surface Tar Body in Removal Action Area (ft NAVD 88)
- Pile Location (surveyed August 2004)
- AN-2-1 Previous Sediment Core Location (Anchor 2002)
- SD063 Previous Sediment Core Location (Weston 1998)
- SD-7 Previous Sediment Core Location (HAI 1996)
- Support Pile Locations (to be protected during dredging)
- Property Line
- OHW = 20.41 ft NAVD 88
- OLW = 7.91 ft NAVD 88
- 50% River Stage Elevation = 10.23 ft NAVD 88

0 50
Scale in Feet

Notes:

1. Bathymetric contours provided by the Lower Willamette Group as part of the Portland Harbor Superfund Site study (2003).
2. Upland topography directed by Anchor Environmental as part of upland investigation (2002).
3. Horizontal Datum: Oregon State Plane North NAD 83 (ft).
4. Vertical Datum: NAVD 88 (ft).
5. Former Drainage Ditch location from Phase 1 Remedial Investigation Summary Report (HAI 1998).

WILLAMETTE RIVER

RAA-14 -33.5
RAA-03 -26.3
RAA-07 -20.7
RAA-13 -22.1
RAA-06 -0.5
RAA-12
RAA-10
RAA-11 3.8
RAA-17
RAA-16
RAA-09 2.7
RAA-05 2.8
RAA-02 -0.6
RAA-01
RAA-04 5.9
RAA-15
RAA-08
RAA-19
RAA-20
RAA-18

SD063
SD064
SD065
AN-2-4
AN-2-2
AN-2-1
SD-7
SD-8

SUPPORT PILES

Approximate Former Drainage Ditch (1940) Location

-40 -30 -20 -10 0 10 20 30.0 30.5 31.0 31.5 32.0 34.0 35.0

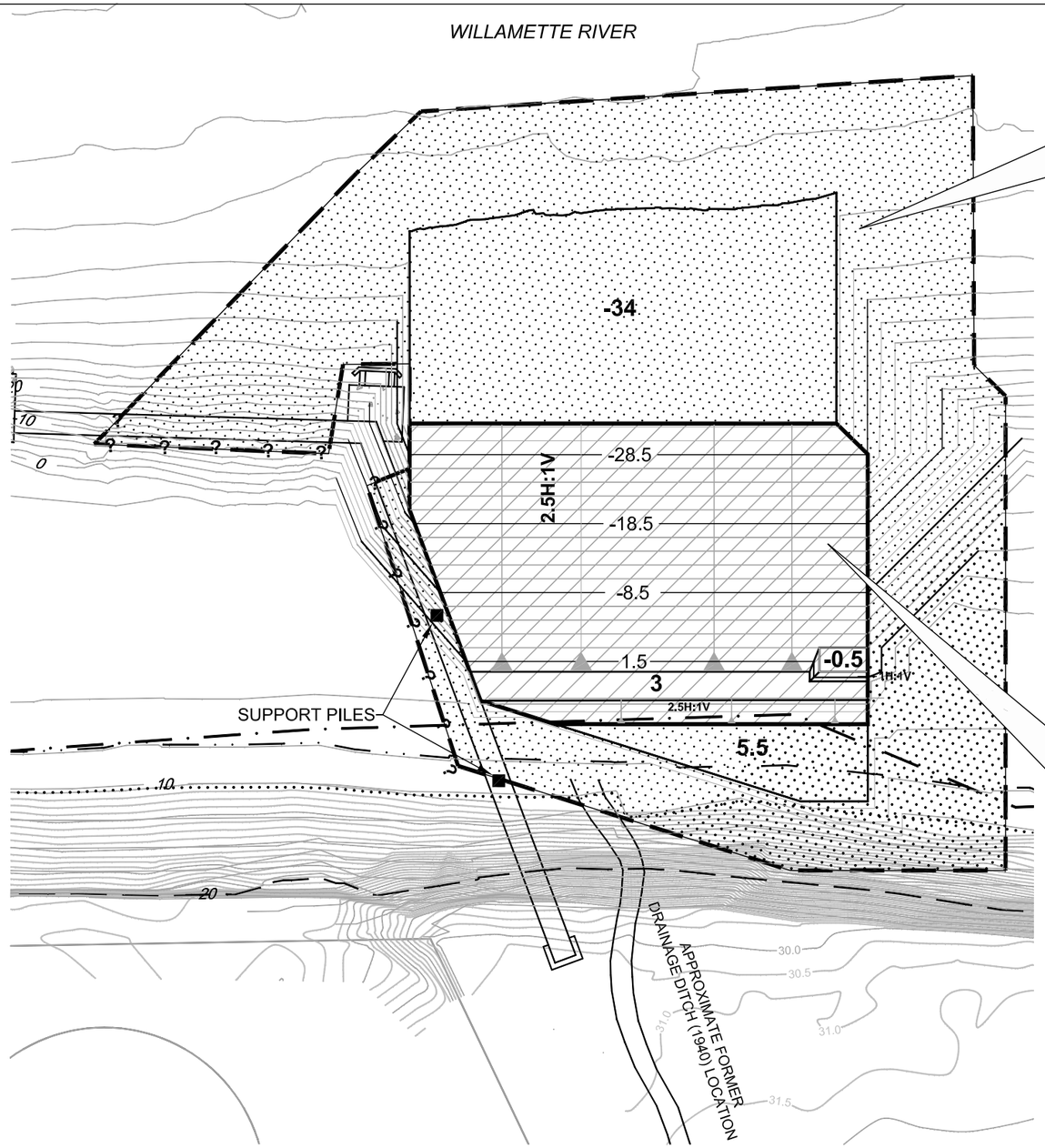
Oct 03, 2005 10:06am dholmer K:\Jobs\000029-GASCO\0000290\0002902\00002902-62.dwg FIG 2

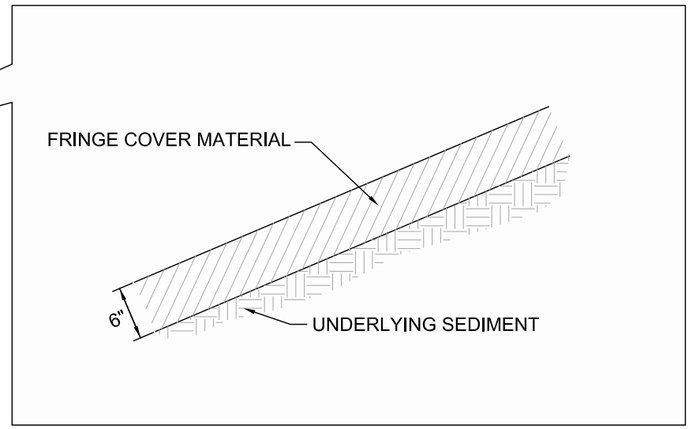
ANCHOR ENVIRONMENTAL, L.L.C.

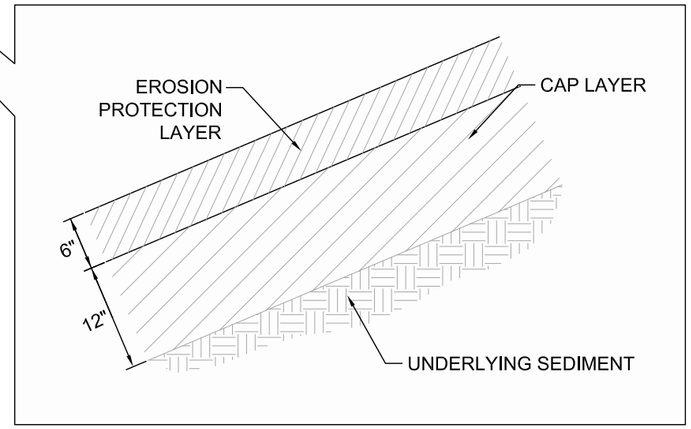
Figure 2
Lateral and Vertical Extents of Surface Tar Body
NW Natural "Gasco" Site

Legend:

- Support Pile Location
- Property Line
- OHW = 20.41 ft NAVD 88
- OLW = 7.91 ft NAVD 88
- 50% River Stage Elevation = 10.23 ft NAVD 88
- 3 — Extent and Elevation of 18 in Thick Cap
- -34 — Extent and Elevation of 6 in Thick Cover







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4. Vertical Datum: NAVD 88 (ft).
5. Former Drainage Ditch location from Phase 1 Remedial Investigation Summary Report (HAI 1998).
6. Slope beneath pipeline support structure allowed to settle to angle of repose - shown at 1H:1V.

Post Cap and Cover Bathymetry

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 3
Post Cap and Cover Bathymetry
NW Natural "Gasco" Site

Legend:

PCM-01 Proposed Subsurface Sediment Core and Porewater Sampling Station

Support Pile Location

Property Line

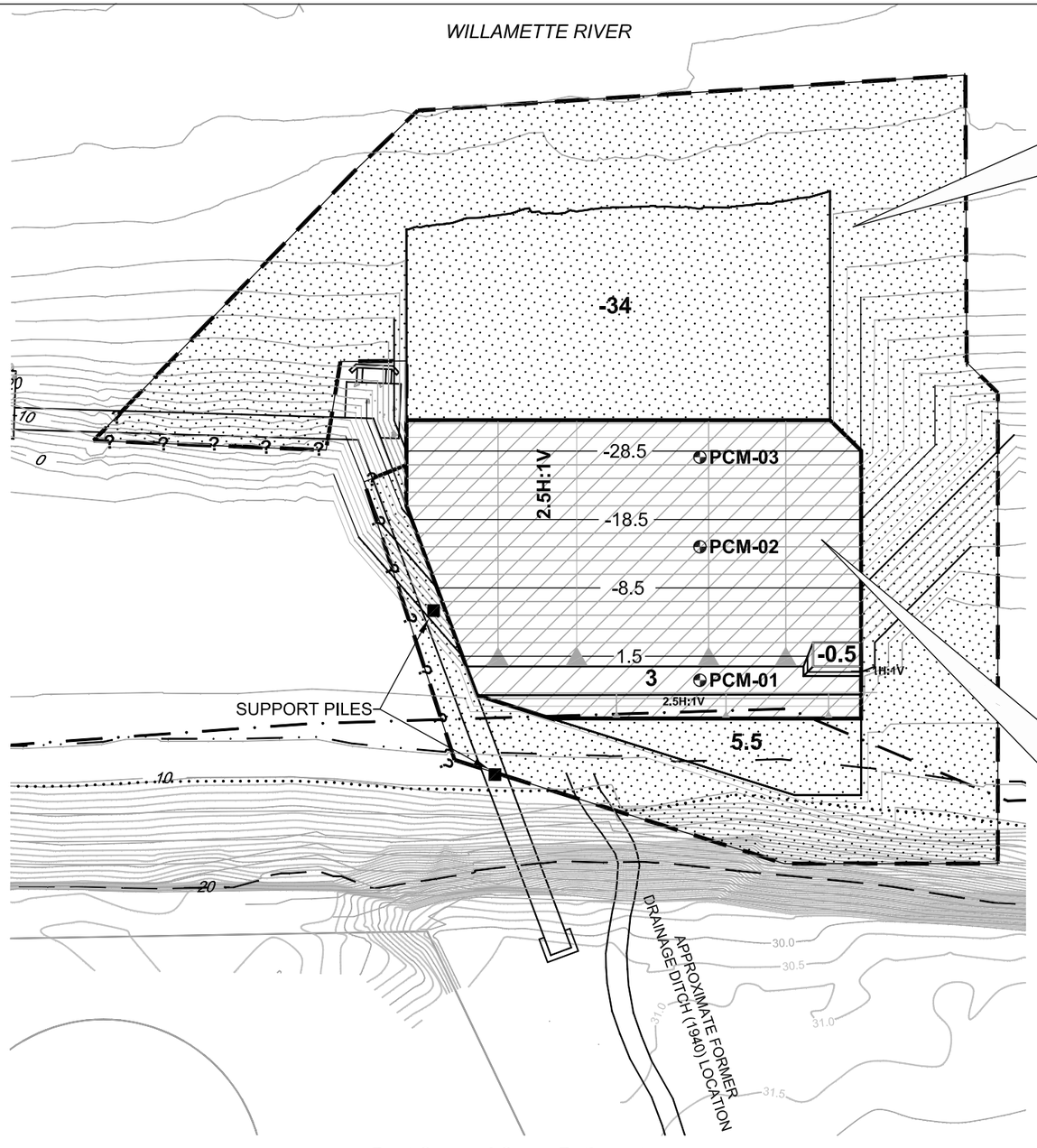
OHW = 20.41 ft NAVD 88

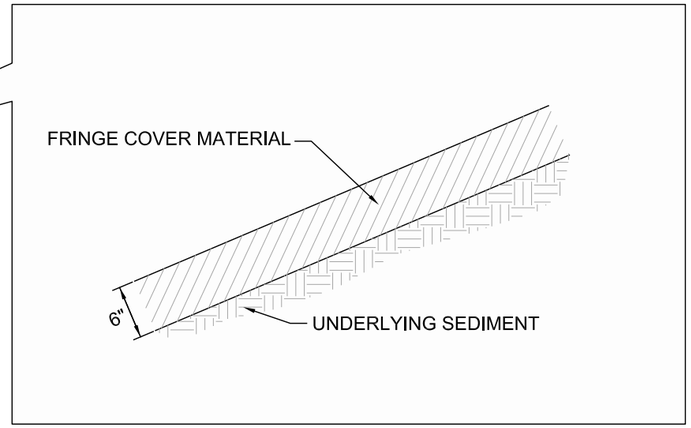
OLW = 7.91 ft NAVD 88

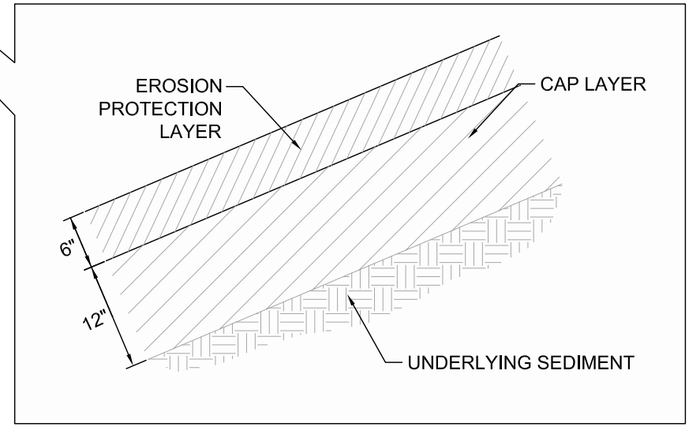
50% River Stage
Elevation = 10.23 ft NAVD 88

3 Extent and Elevation of 18 in Thick Cap

-34 Extent and Elevation of 6 in Thick Cover







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5. Former Drainage Ditch location from Phase 1 Remedial Investigation Summary Report (HAI 1998).
6. Slope beneath pipeline support structure allowed to settle to angle of repose - shown at 1H:1V.

Post Cap and Cover Bathymetry

0 50
Scale in Feet

Oct 04, 2005 11:16am dholmer K:\Jobs\000029-GASCO\000029020000290200002902-109.dwg FIG 4

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 4
Proposed Co-Located Subsurface Sediment and Porewater Sampling Stations
NW Natural "Gasco" Site

APPENDIX A

FIELD SAMPLING PLAN

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN